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ABSTRACT

Modelling TOVS Radiances of Synoptic Systems.

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Two operational analysis models, produced by ECMWF and NMC, are intercompared against observed satellite radiances by converting the analyzed variables into synthetic radiances using a radiative transfer model (RTM). Observed TOVS satellite radiances are used as a ground truth, since they are the only source of continuous, synoptic-scale resolution observations available over the data-sparse tropical Pacific Ocean. It is assumed that if the analysis models correctly simulate atmospheric conditions, the observed and modelled radiance fields will have similar patterns and magnitudes.

In each of seven TOVS channels examined, the mean temperature difference between the models was small, but the differences between the models and the observations were large. The mean temperature difference within each channel was larger than the standard deviation in most cases. The moisture channels of the RTM were sensitive to changes in moisture content, but none of the channels were significantly affected by changes in temperature. Single-day modelled radiance analyses contain synoptic information similar to the satellite observations. ECMWF is often too noisy, producing features not verified by the satellite; NMC is often too smooth. NMC more closely resembles the TOVS contours. Modelled water vapor channel analyses resemble observed monthly and composited observations well, but do not accurately reproduce the highly-variable single-day

fields. ECMWF generally has more accurate gradients. Neither model simulates the tropics well.

The water vapor channels, especially channel 11 (weighted at 700 mb), most closely resembled the tropical plume composite described by McGuirk and Ulsh (1990). The only plume evidence found in the thermal or microwave channels, in either the observations or the models, was a composite trough situated in the correct location, extending from the midlatitudes into the subtropics. This feature was not readily discernable until the definition and mature stages. Additional information besides the modelled temperatures would be required to produce an accurate forecast for the tropics.

Model patterns more closely resembled the observations in the quiescent atmosphere, though the magnitudes were not any closer. ECMWF simulates the TOVS quiescent state better than NMC. The moisture channels continue to present the most realistic patterns. The models contained more detail in the tropics than was verified by the satellite observations, apparently trying to force an active ITCZ. Lag correlations showed TOVS to be more persistent than the models. TOVS also showed a smoother lag trend, but all products appeared to have adequate ability to react to changes in the atmosphere over time.